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AD-E403 348

Technical Report ARMET-TR-09045

## **BALL DROP IMPACT TEST FOR PRIMARY EXPLOSIVES USERS MANUAL**

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August 2011



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# **20110906014**

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REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-01-0188	
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1. REPORT DATE (DD-MM-YYYY) August 2011		2. REPORT TYPE		3. DATES COVERED (From - To)	
4. TITLE AND SUBTITLE  BALL DROP IMPACT TEST FOR PRIMARY EXPLOSIVES USERS MANUAL				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHORS  Theodore Dolch and Neha Mehta				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army ARDEC, METC Energetics, Warheads & Manufacturing Technology Directorate (RDAR-MEE-W) Picatinny Arsenal, NJ 07806-5000				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army ARDEC, ESIC Knowledge & Process Management (RDAR-EIK) Picatinny Arsenal, NJ 07806-5000				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S) Technical Report ARMET-TR-09045	
12. DISTRIBUTION/AVAILABILITY STATEMENT  Approved for public release; distribution is unlimited.					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT  This method is the test that is appropriate for determining the impact sensitivity of primary explosives. It was developed at the U.S. Army Armament Research, Development and Engineering Center, Picaitnny Arsenal, New Jersey. This test is required for qualification and Final Hazard Classification of a primary explosive for use in U.S. Army end items. This technical report will serve as a reference for this test method.					
15. SUBJECT TERMS  Impact test      Final Hazard Classification (FHC)      Primary explosive					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT  SAR	18. NUMBER OF PAGES 11	19a. NAME OF RESPONSIBLE PERSON Ted Dolch
a. REPORT U	b. ABSTRACT U	c. THIS PAGE U			19b. TELEPHONE NUMBER (Include area code) (973) 724-2376

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## INTRODUCTION

This method is the test that is appropriate for determining the impact sensitivity of primary explosives. It was developed at the U.S. Army Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, New Jersey.

## TEST ARRANGEMENT

The ball drop impact test apparatus (fig. 1) subjects a primary explosive to an impact of a free-falling steel ball. The standard sample size is 30 mg for each trial. A 0.75-in. diameter, 1-oz, 316 stainless steel ball is normally used. The steel ball is guided on a ball track that rises 32 in. vertically from a steel base. The ball track may be moved up or down and locked in place. A tool-steel block hardened to 60 to 62 Rockwell C is used as the sample holder. The block is 2.245 in. by 2.760 in. by 1.215 in. high. The steel block has two elevated shoulders on its top, 0.45 in. wide by .080 in. high. The top surface is polished to a 4 to 6  $\mu$ -in. finish. All other surfaces are polished to a 125  $\mu$ -in. finish.

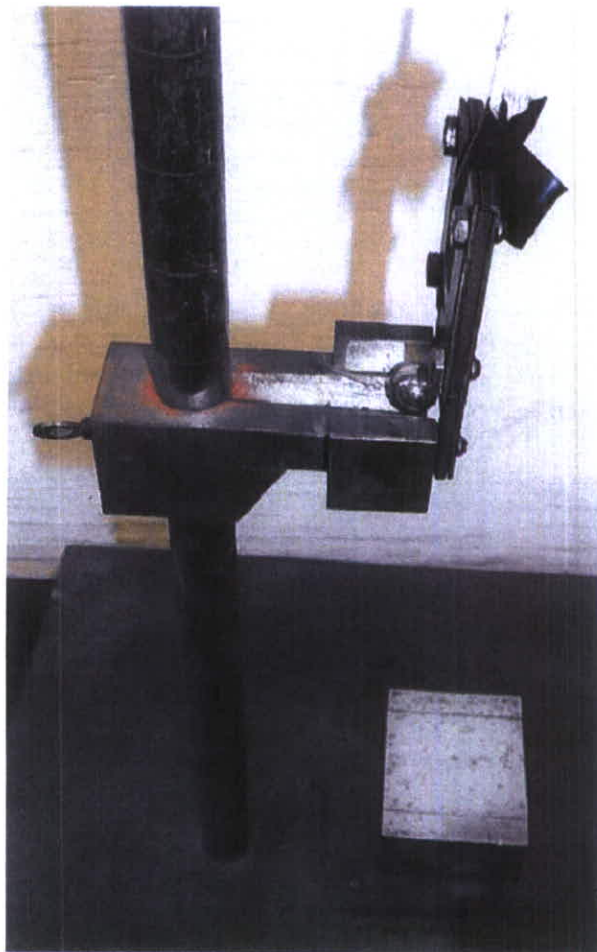


Figure 1  
Ball drop tester for primary explosives

## TEST SETUP

The steel ball guide is raised to the desired height and locked in place. The empty impact block is placed beneath the ball track so the center of the block is about ½-in. beyond the end of the track. A ball track metal shield is used to keep the steel ball in place. The ball track shield is in the lowered position and the steel ball is placed in the track. The cord is pulled so as to allow the steel ball to drop onto the block (note where on the block the ball falls). If necessary, relocate the block so that the ball will fall approximately on the center of the block. This step is repeated until the block is properly located then its location is marked on the steel base of the stand by means of chalk or masking tape so the block can easily and quickly be placed in the proper position in subsequent tests.

## SAMPLE PREPARATION

Samples are tested in powdered form. A test sample is usually dried in an oven at 120°F to a constant weight before testing.

## TEST PROCEDURE

An iterative procedure is used to determine the highest height at which no positive results are obtained in 20 trials. This value is considered the threshold of initiation level (TIL). The TIL values for an explosive, when accompanied by data for other explosives that have been tested in the same manner and on the same machine, can be used to rank the impact sensitivity of the explosive.

The test sample of approximately 30 mg is placed on the impact block. The sample is spread into a thin layer by moving a straight-edged conductive spatula along the top of the shoulders of the impact block. The loaded impact block is positioned beneath the ball track. The ball track shield is in the lowered position and the steel ball is placed in the track. The ball track shield is raised using a cord and the steel ball is allowed to fall onto the sample. If no explosion or reaction occurs, the test is repeated with a fresh sample from successively greater heights until a reaction occurs or until the maximum range of the equipment is reached. If a reaction does occur, fresh samples are tested at successively lower heights until a point of no reaction is reached. Thereafter, a sample will be tested at 1 in. below the level at which the previous sample was tested if that sample reacted, and 1 in. above the level at which the previous one was tested if it did not react.

A Bruceton up-down method may also be employed to determine the height,  $H_{50}$ , at which the probability of reaction is 50%.  $H_{50}$  values for an explosive, when accompanied by data for other explosives that have been tested in the same manner and on the same machine, can be used to rank the impact sensitivity of the explosive.

The determination of an explosion or reaction is based on visual observation. Any indication of decomposition (explosion, burning, flash, smoke, or charring) is considered a positive reaction.

## DATA REPORTING

The following information shall be reported for this test:

- Sample weight
- Method of endpoint detection, such as:
  - Sound - microphone/recorder arrangement, ear
  - Go/no go determination methodology
  - Smell
  - Sight - flash, smoke, etc.
  - All or combination of above
- Number of drops per test
- Number of test replications
- Method of data analysis
- Experimental material result with standard deviation (if applicable)
- Reference material result with standard deviation (if applicable)





## BIBLIOGRAPHY

"Ball Drop Test," MIL-STD-1751A, Method 1016, December 2001.

## DISTRIBUTION LIST

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